

48-747 Shape Grammars

*The Grammar of Taiwanese Traditional
Vernacular Houses*

my variation on a theme

undertake a *study* of an architectural *style*,
extract from it mathematical and *computational principles*,
formalized into a *system* of compositional *rules*,
that can be described in a *language* – which,
ultimately, will provide the means
for *visual* and *interactive explorations* on a computer

a personal motivation

Historic preservation of Chinese buildings

Effect on contemporary Chinese designs

Teaching of Chinese architecture and architectural history

a public why?



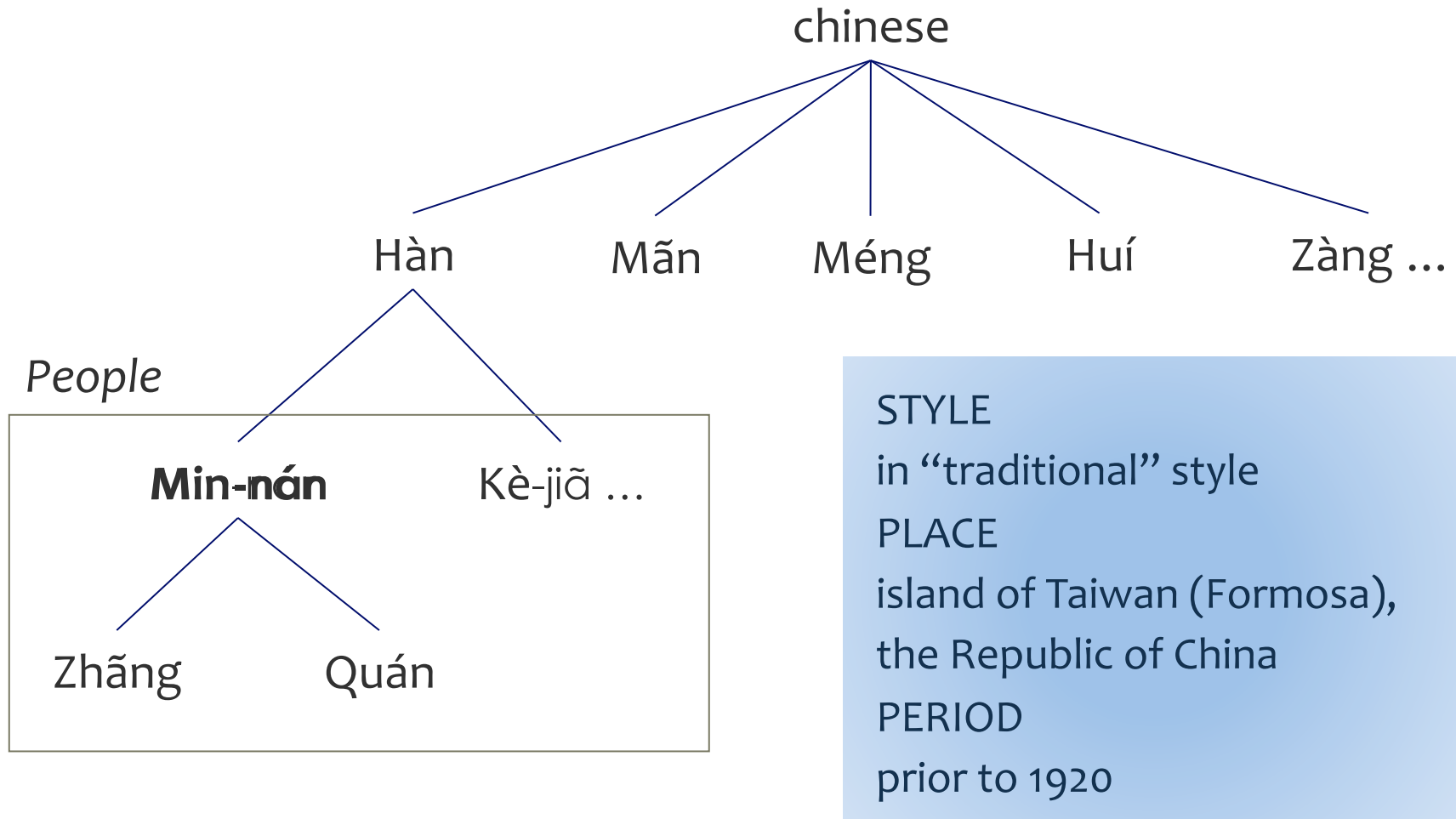
no extant plans ... no drawings, no designs (as such)



(instead) there was a **process** – the **gao-chi**



a cultural excursion + a variation on a theme

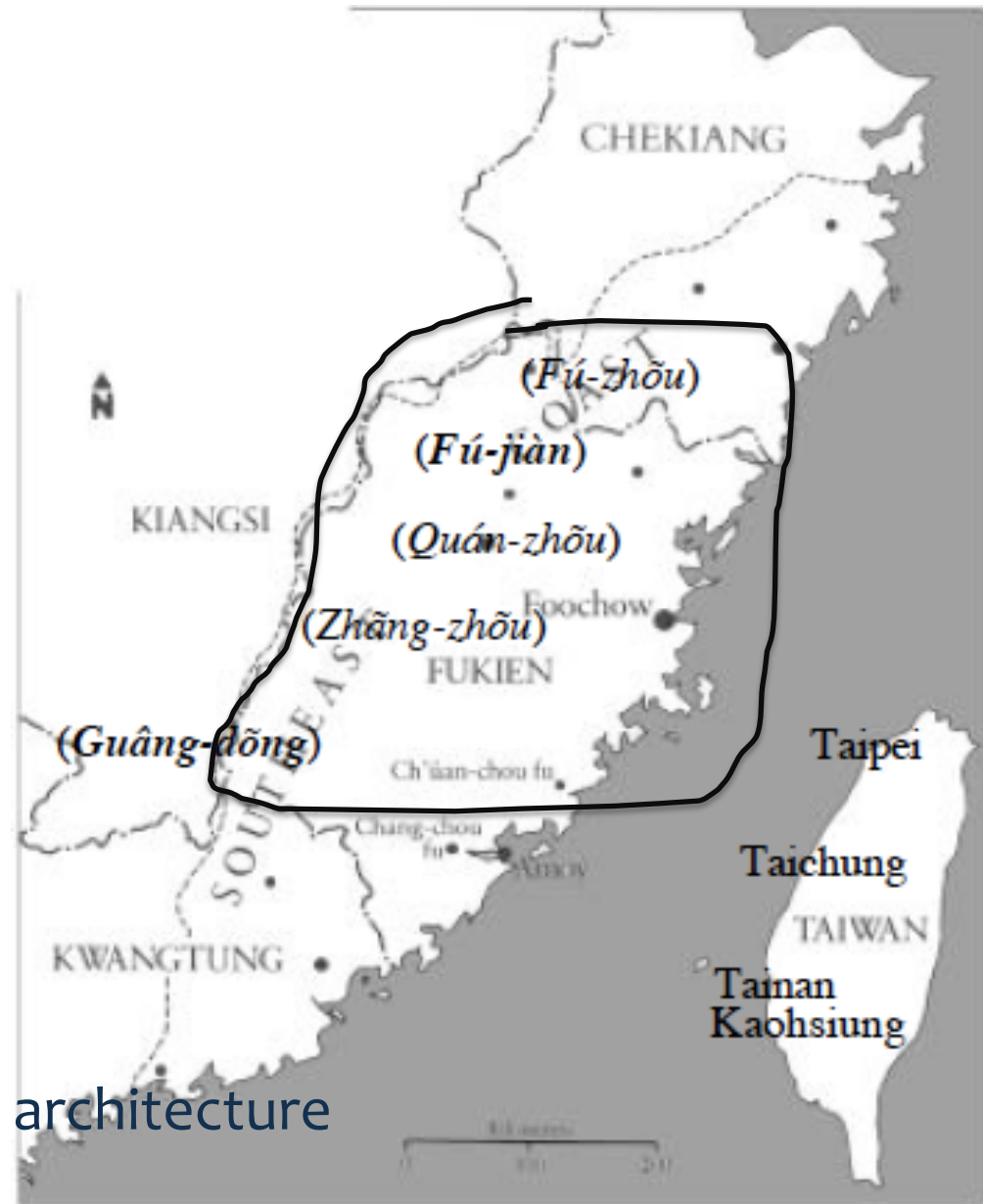


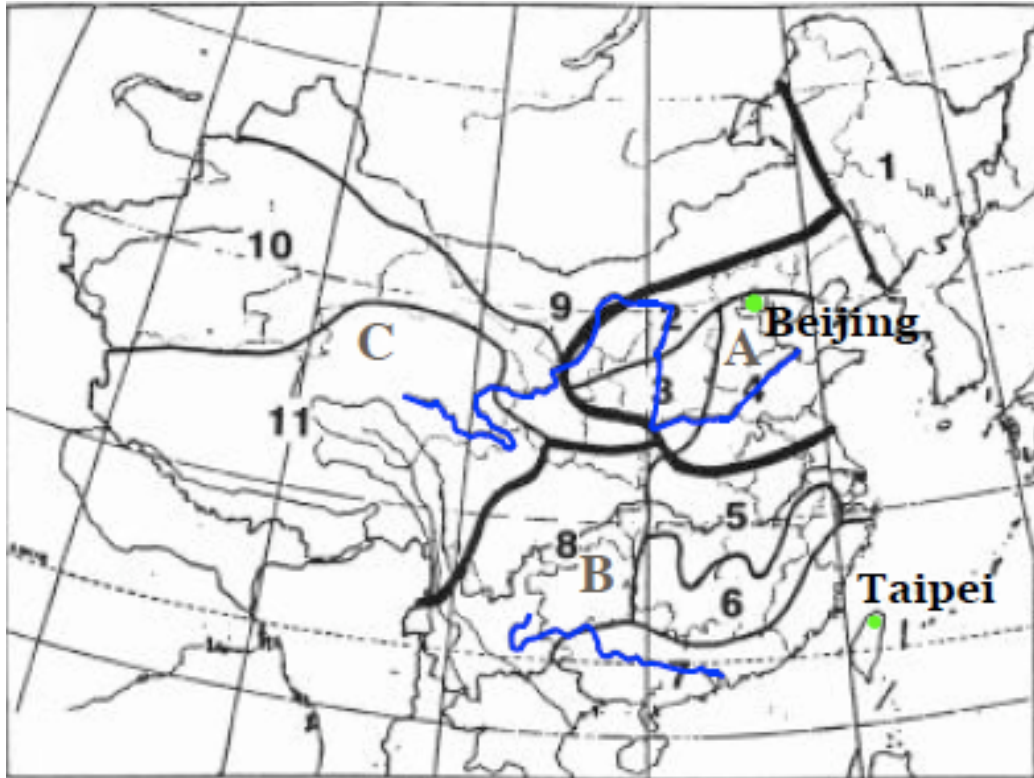
what is traditional taiwanese architecture?

influence of Fujian
and Guangdong
architecture on the
province of Taiwan

based on the work of
chiou, shang-chia

southern style chinese architecture





Northern Style

- Northeast China
- Great Wall
- Loess Plain
- North China Plain

Southern Style

- Middle lower Yangzi River
- South Yangzi River Hill

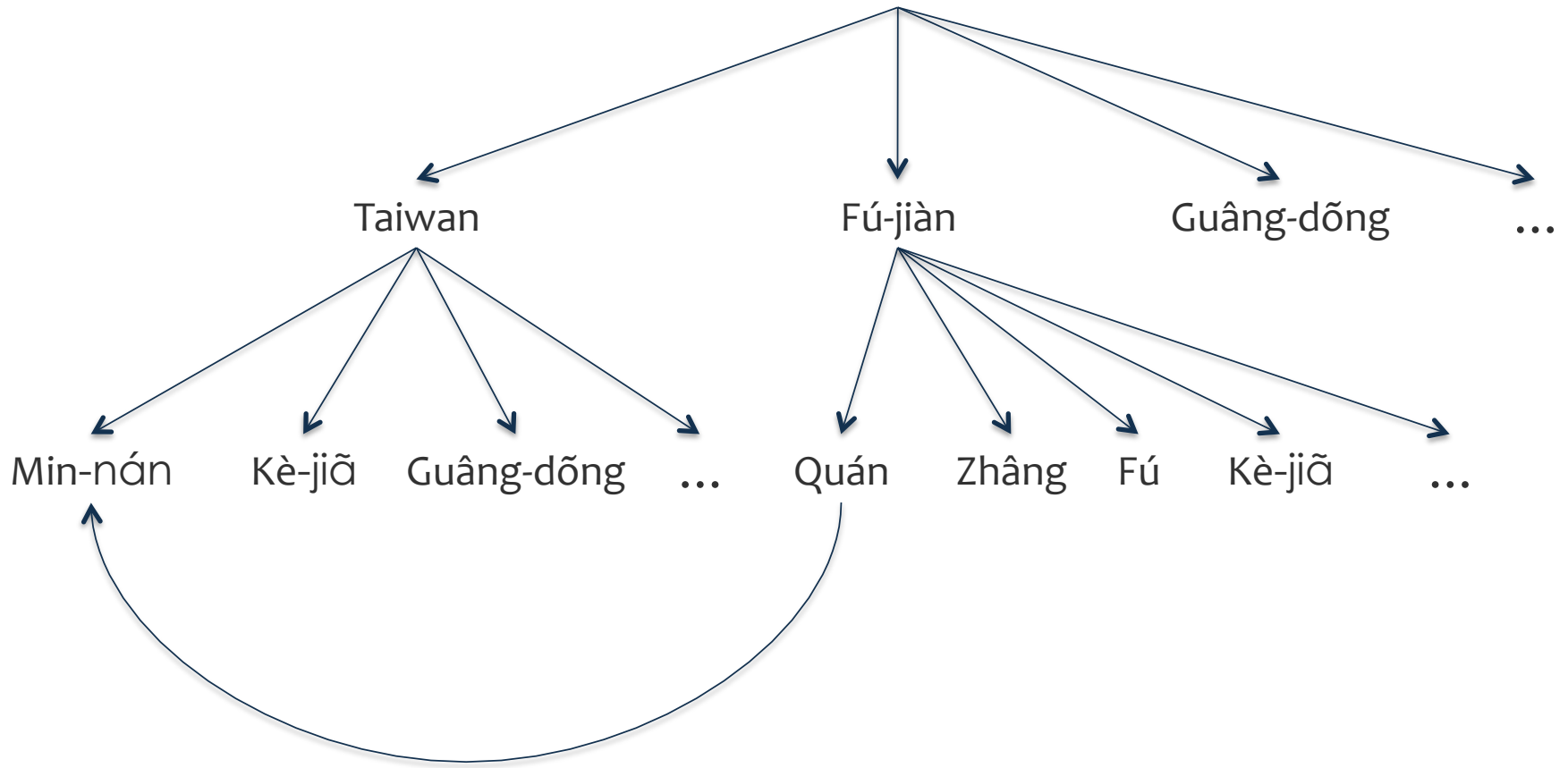
Southeast Coast

- Southwest

Western Style

- Northern
- Northwestern
- Qinghai-Xizang (Tibet)

a branch of chinese architecture



architectural style of the south east coast

people

courtyard

roof

feng-shui

human proportions

confucian order

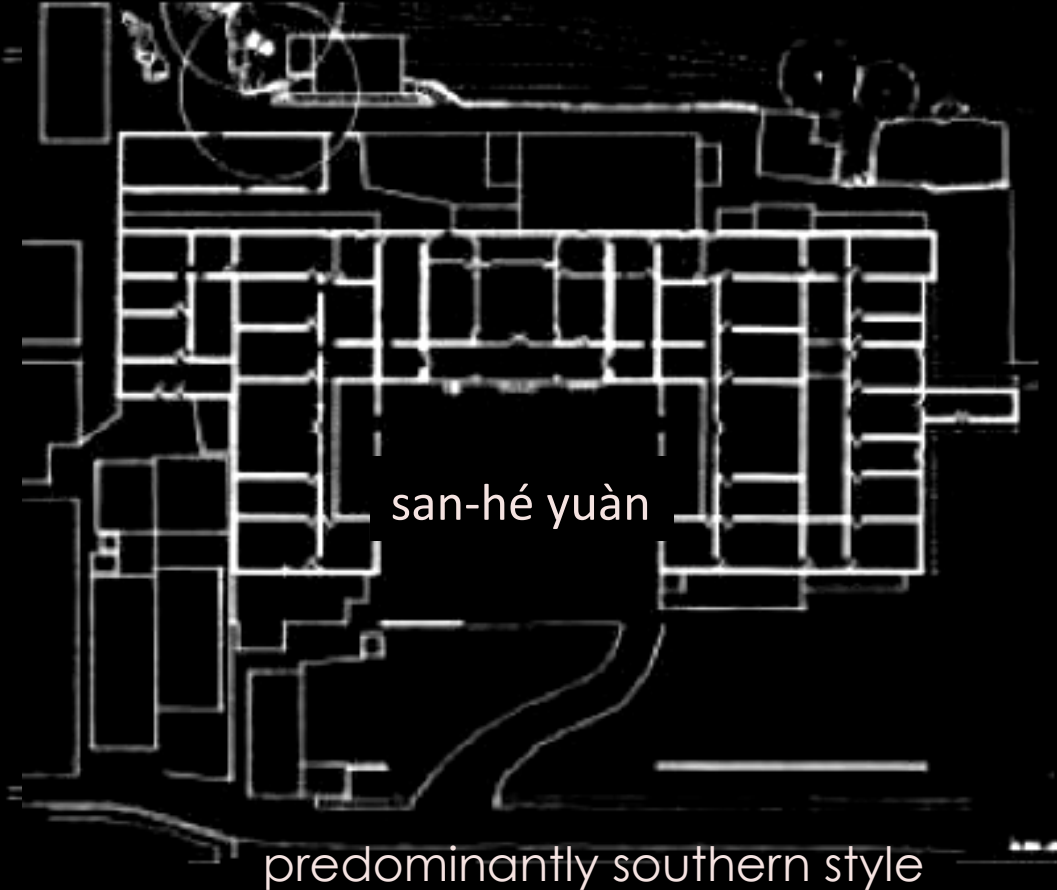
yi ching (*change*)

factors that affect chinese architecture

predominantly northern style

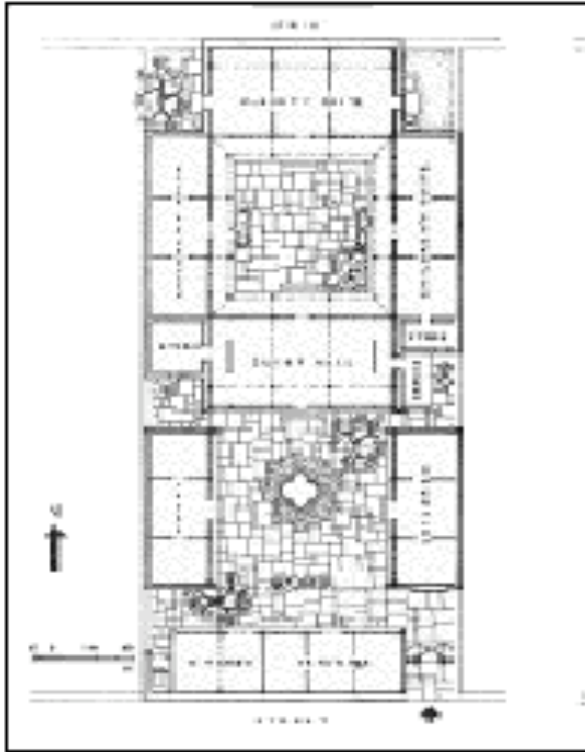


courtyard style



predominantly southern style

si-hé yuàn



Si-he yuan
Predominantly Northern Style

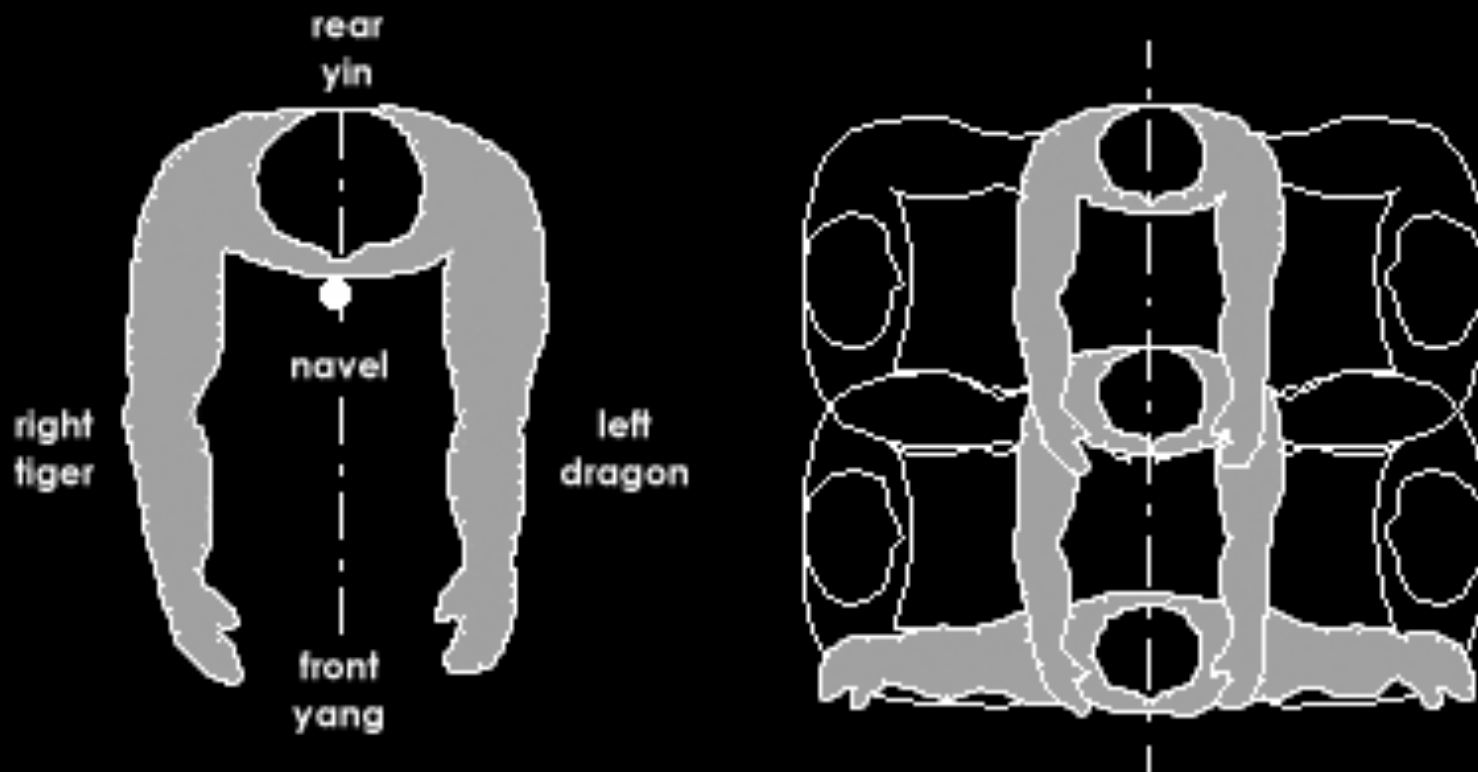
courtyard style

san-hé yuàn

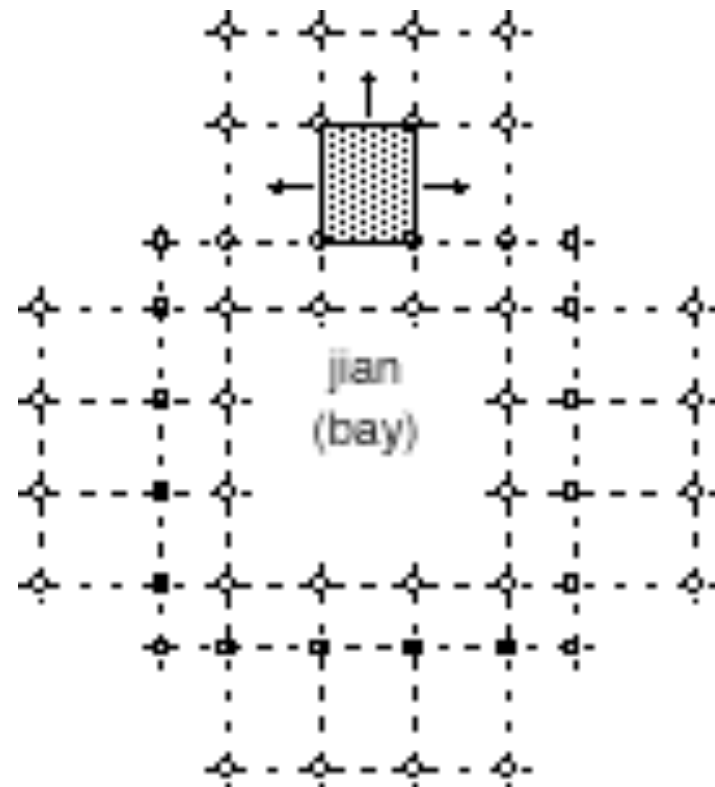
San-he yuan
Predominantly Southern Style







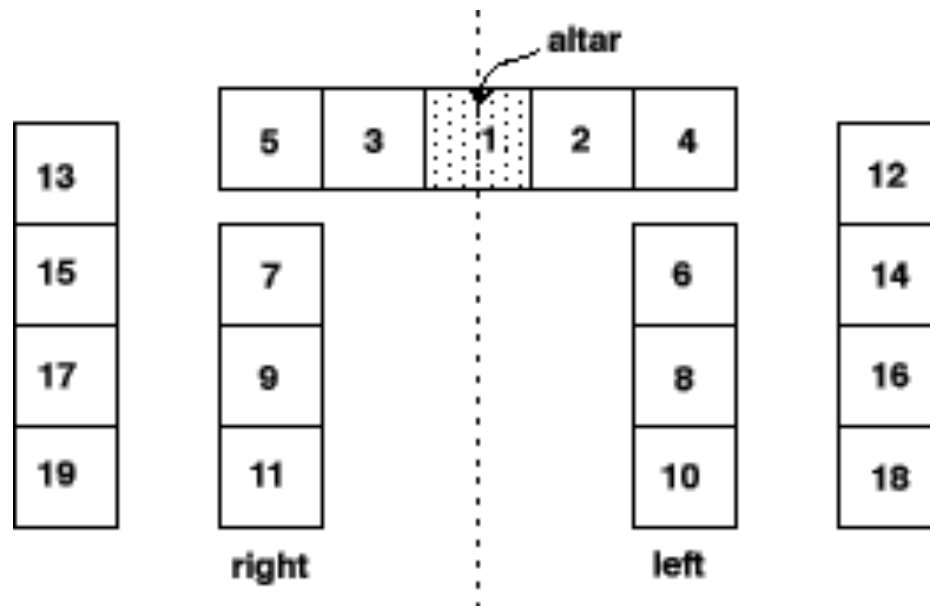
spatial concept – boundary of human beings



jīn (finished)	shǒ (tip/end)	cǐ (secondary)	ming (light)	cǐ (secondary)	shǒ (tip/end)	jīn (finished)
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Terminology for a typical tang-wu

compositional unit



ethical order concept



northern style



southern style

roof style



wu-dian



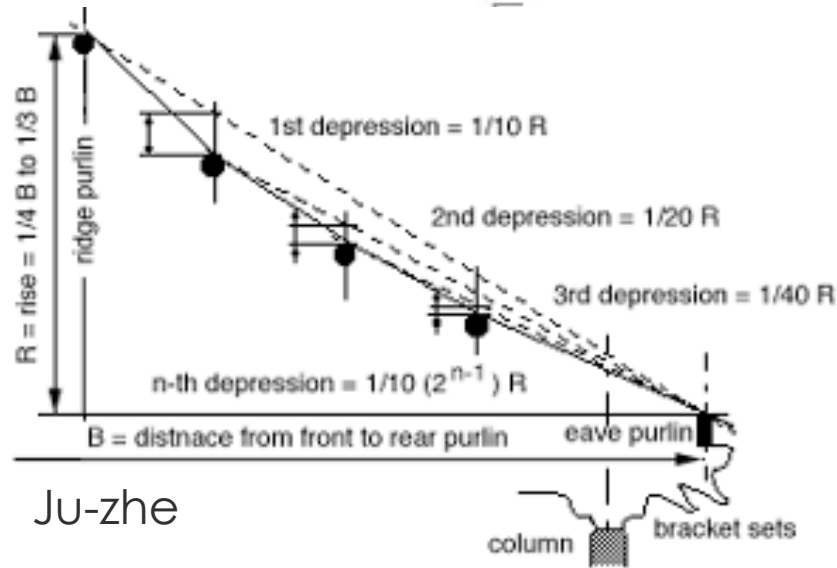
xie-shan



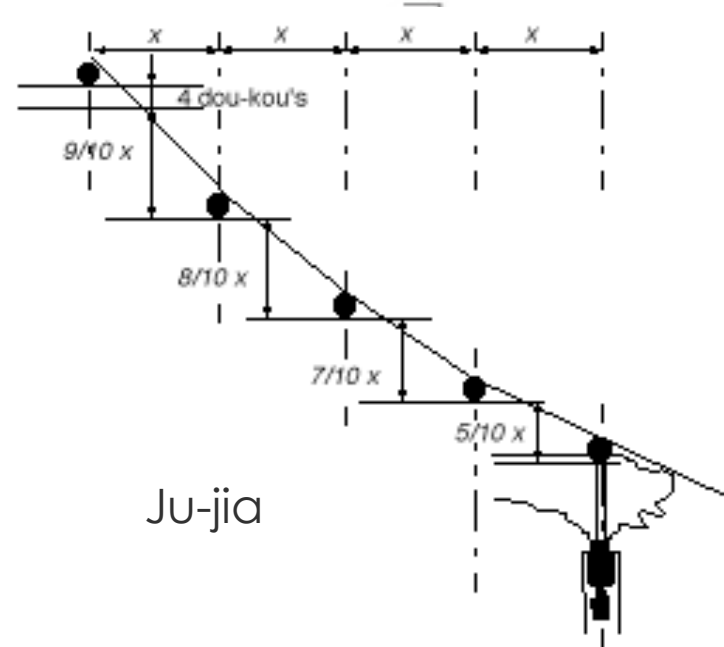
ying-shan



xuan-shan

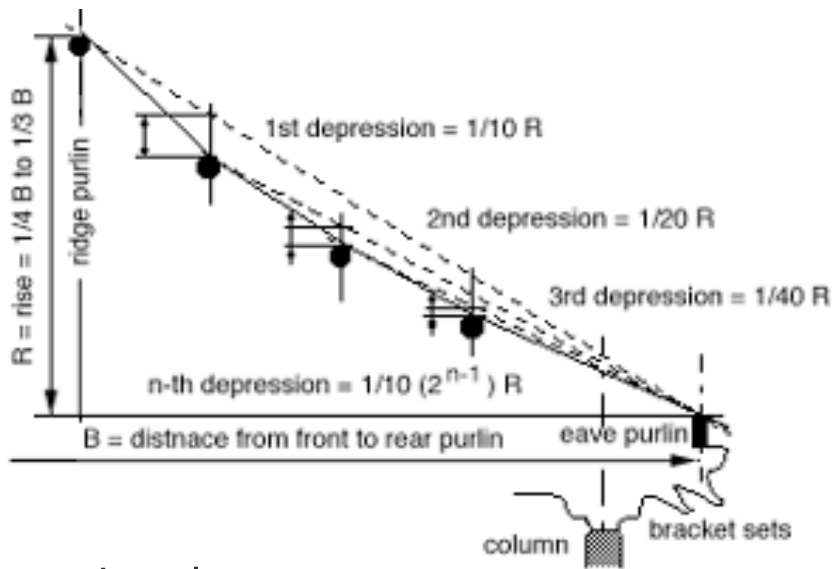


Ju-zhe

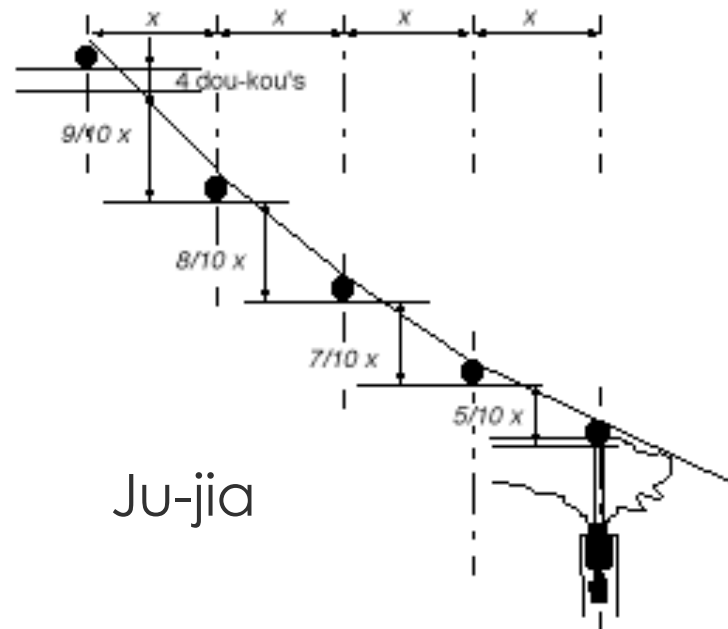


Ju-jia

roofs

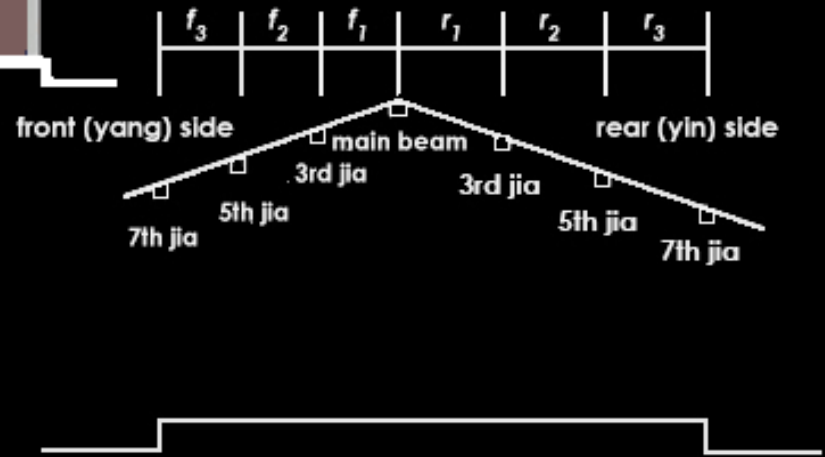
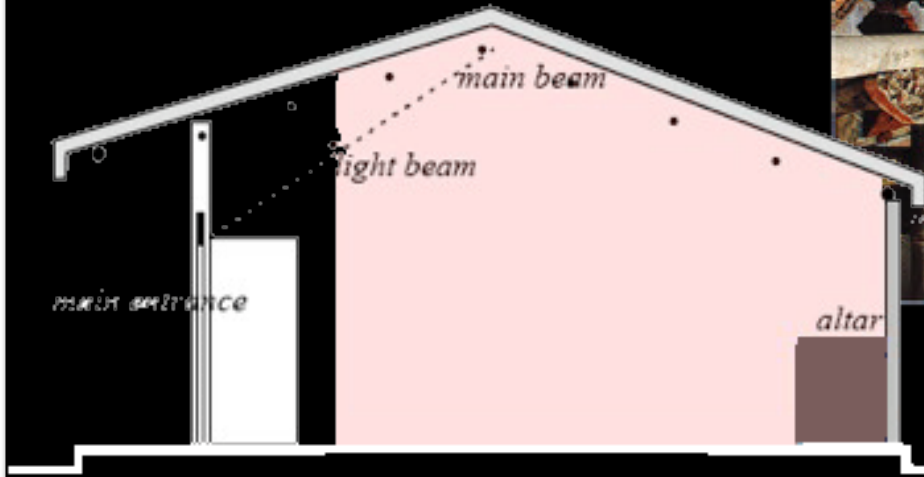


Ju-zhe



Ju-jia

roofs

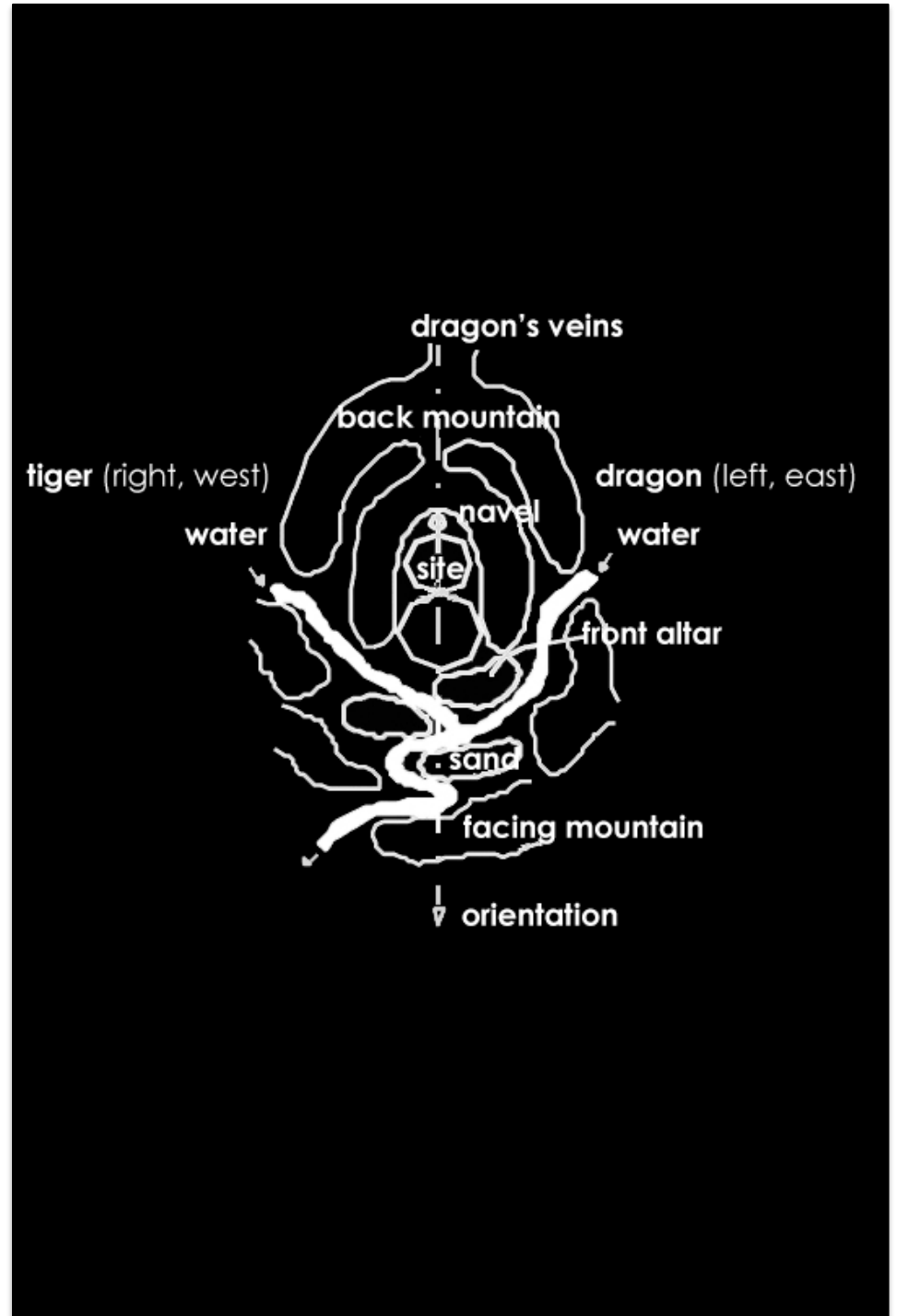


roofs

"A site should be surrounded on three sides by higher land, like the crook of the elbow in a curved arm, to provide protection from inclement weather or an enemy. The lie of the land should be gently sloping and, if possible, there should be a river or valley nearby to allow surface water to drain easily."

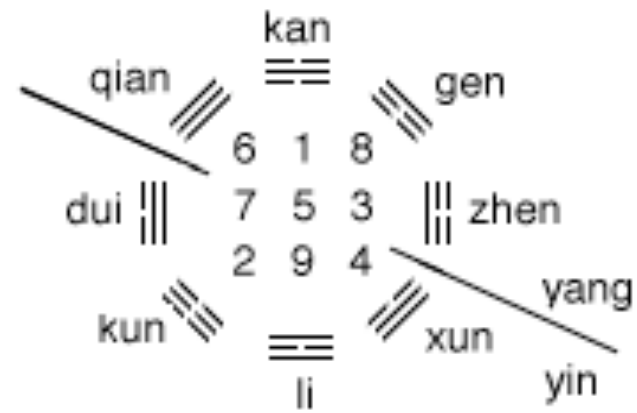
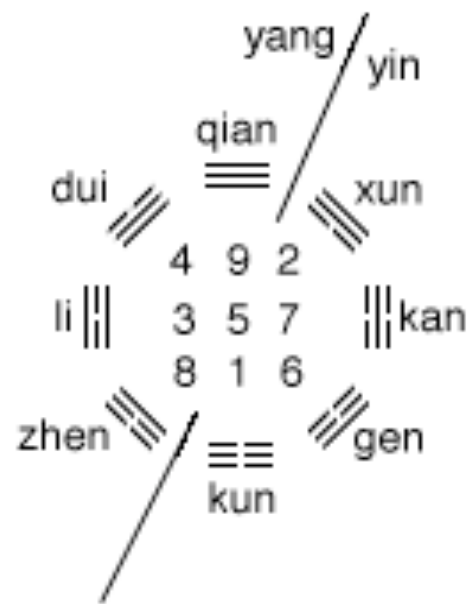
The Burial Book (Zang-shu
trans. by Lawrence Liu (1989))

feng-shui: wind + water





yi-jing (change)



heavenly orders

Lu-Ban

The 'Lu-Ban' application is used to determine pre-design or pre-construction information, namely 'Propitious Location,' 'Auspicious Construction Date,' and 'Fortunate Dimensions,' in Chinese or Taiwanese traditional architecture. They are based on the principles of Feng-shui (Chinese geomancy).

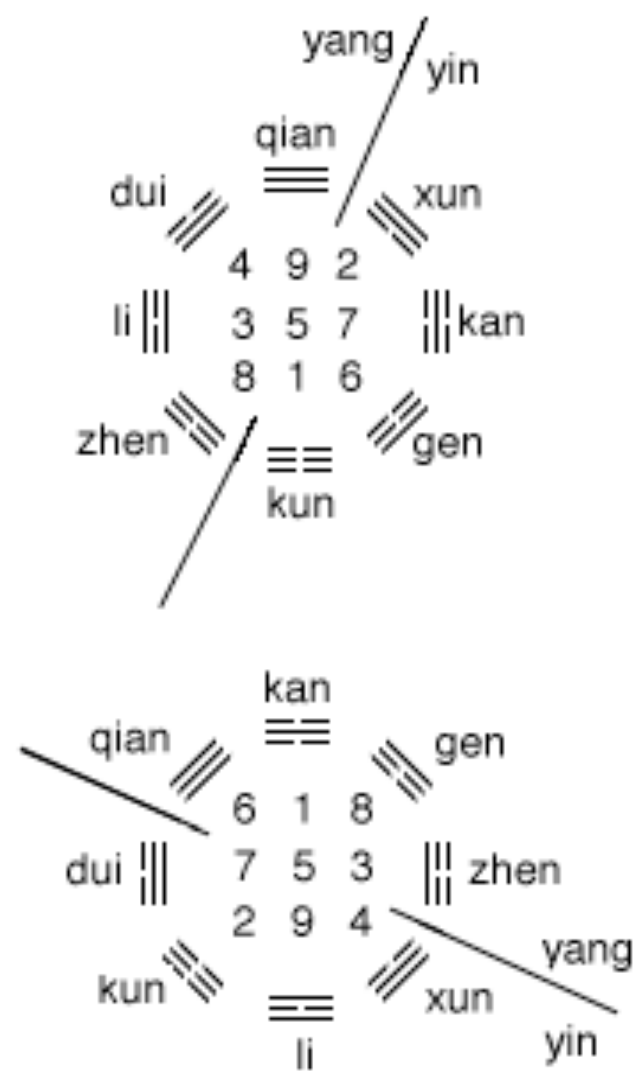
Propitious Location & Construction Date Fortunate Dimensions Quit

LuBan: Compass for Fortunate Dimensions



lu ban

Location	Facing	Orientation	Element
Shen	Yin	60 ° 0' 0"	metal



Lu Ban ruler

A Lu Ban foot = 10 Lu Ban inches = 29.69 cms

Opening Ruler

(Mén-guǎng chí)

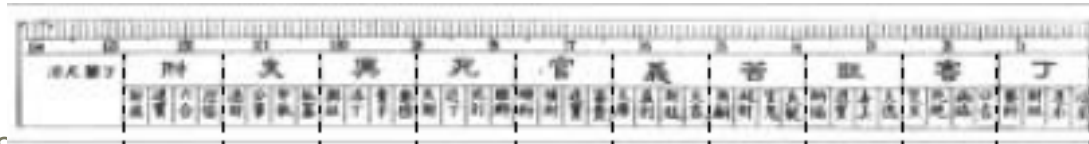
8 intervals = 1' 4.4" = 42.70 cms



Worship Ruler

(Ding-lán chí)

10 intervals = 1' 2.8" = 38.01 cms



Stride Measure (bù-fâ)

a stride = 4' 5" (1.336 m)

Step Measure (tà-fâ)

a step = 3.5" (10.6 cms)

measurements

LuBan: Fortunate Dimensions

The "fortunate dimensions" refer to a set of measurements for the main spaces of a traditional building. The dimensions, regarded as omens of good fortune and still widely used in Taiwan and China, are based on the principles of Feng-shui.

Constraint (Lu-Ban foot)

Height:		min.:	10	max.:	15
Depth:	1.3 x Height	min.:	13	max.:	20
Width:	1.0 x Height	min.:	10	max.:	15

Fortunate measurements (Lu-Ban foot/inch)

	Fortune	Element	Relation
Lu-Ban foot	good	metal	identical
Lu-Ban inch	fair	wood	destroy

Conversion

Lu-Ban	strides	steps	centimeters
12' 3"	2.73	35.14	365.27

LuBan: Propitious Location & Auspicious Construction Date

The "propitious locations" are based on principles of Feng-shui, known as "right buildings," for determining a building's fortunate orientation. The "auspicious construction date" can be decided either by orientation using the "Canon of Buildings," or by the owner's date of birth using the "Ten Books of Buildings for Yang."

Person's birth information (in Lunar Calendar)

Gender	Year	Month	Day	Hour
masculine	1965	8	11	11:20

Innate Characteristics

Feature	Eight Characters		
Heavenly	Yi_Si	Yi_You	Gui_Hai
Cycle	Essence	Category	
Middle_cycle	Gen	West 8	

Propitious Location

Auspicious Construction Date (in Lunar Calendar)

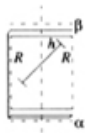
Based on the "Canon of Buildings"

Location	Fortunate Month	Unfortunate Months
Shen	9	3, 12

lu ban

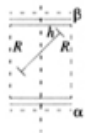


1. Examine site, choose auspicious orientation
2. Negotiate (artisan, owner, geomancer)
3. Decide upon the 'form'
4. Purchase materials
5. Breaking ground (ceremony)
6. Marking the layout on the site
7. Construct platform
8. Construct main walls
9. Erect main walls, place main beams
10. Construct roof and mortar walls
11. Clean up
12. Thanking the gods (ceremony)



Defining the initial shape

Defining the scales of the building



Computing the fortunate dimensions of the central room

Generating the central room

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Adding extra space to the central room and refining it

Adding openings to the central room



Extending the main building by adding rooms laterally

Refining the main building with openings and extra space



Generating a courtyard

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Generating a secondary building



Clearing labels

Generating the raised platform

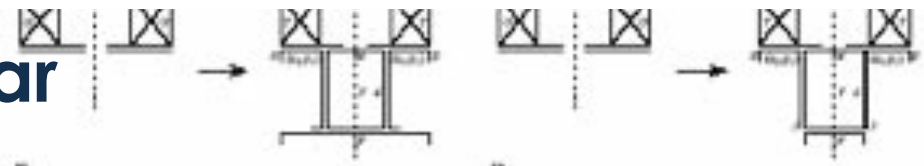


Generating the form of the central room

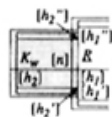
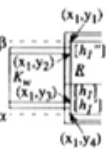
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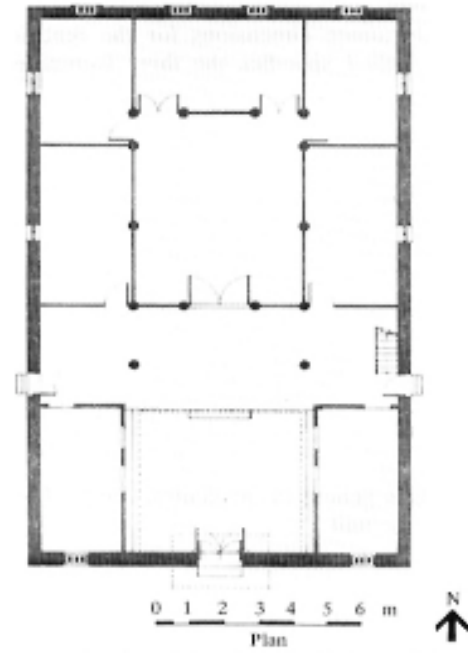
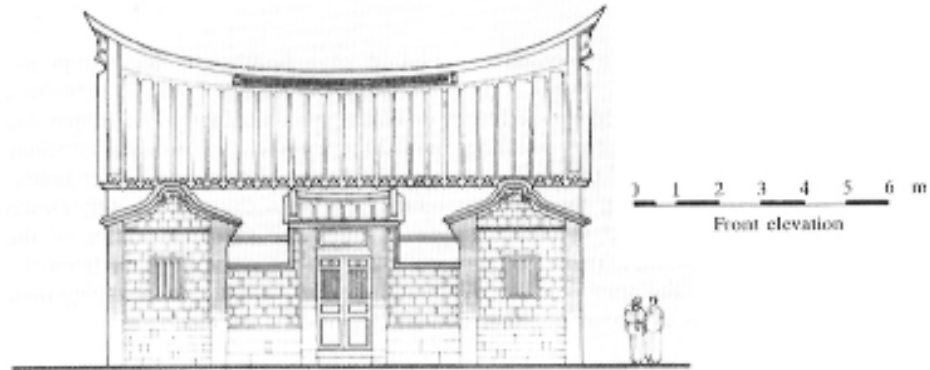
Generating the entire form of the main and secondary building

taiwanese grammar



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zhou family house

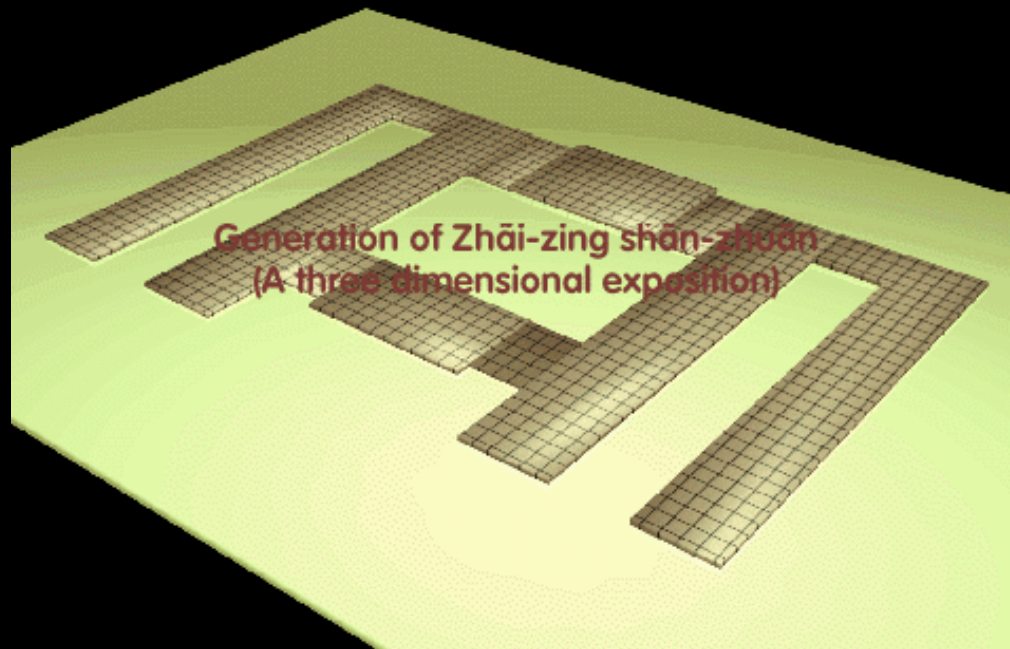


zhou family home

perfection is achieved,
not when there is nothing more
to add,
but when there is nothing left to
take away

antoine de saint exupéry

simplicity was the goal



Generation of Zhāi-zing shān-zhuān
(A three dimensional exposition)